TITLE OF THE INVENTION

A RECORDING MEDIUM STORING LINK INFORMATION AND APPARATUS AND METHOD FOR LINKING DATA

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2000-69018 filed on November 20, 2000, in the Korean Industrial Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to an optical recording medium and a reproducing apparatus and method, and more particularly, to a recording medium storing information regarding data in the current sector as data in a linking loss area, and an apparatus and method linking data.

2. Description of the Related Art

[0003] Since basic recording units of a digital versatile disc-rewritable (DVD-RW) are positioned one after another in a continuous series, in contrast to those of a DVD-Random Access Memory (DVD-RAM) which are divided by physical identifier (PID) areas or buffer fields (extra areas allocated to correspond to a requirement for controlling a spindle motor accurately), it is required that a recording-start point of each basic recording unit in a DVD-RW is precisely located. Here, the basic recording unit of the DVD-RAM may be a sector and the basic recording unit of the DVD-RW may be an error correction code (ECC) block.

[0004] Since the basic recording units of the DVD-R and the DVD-RW, which have the same physical formats, are positioned in a continuous series as described above, when data transmission or recording is momentarily discontinued or subsequently recommenced, the DVD-R and the DVD-RW use a linking scheme in which an extra area of a next recording-start point is allocated. The sizes of a linking area which is applied to the linking scheme are 0 kilo bytes (KB), 2KB, and 32KB.

[0005] FIGS. 1A through 1C are schematic diagrams showing conventional data linking methods. FIG. 1A shows the data structure of a 2KB linking method, FIG. 1B shows the data

structure of a 32KB linking method, and FIG. 1C shows the data structure of a 0KB linking method. In the conventional linking methods as shown, if the data type in sector information is '1b', this indicates that the next sector is a linking loss area. The linking loss area has no effective data and only stores dummy data, that is, '00h'. Therefore, main data recorded in a subsequent area is replaced with '00h' regardless of reproducing data, and therefore correction of an ECC block can be improved.

[0006] FIG. 1A shows a data structure in which the size of a linking loss area is 2KB, and FIG. 1B shows a data structure in which the size of a linking loss area is 32KB. If user data does not fill an entire first ECC block, padding data is recorded in the remaining part of the first ECC block. If the data type of the last sector of the first ECC block is '1b', the first sector (2KB) of the second ECC block or an entire second ECC block (16 sectors = 32KB) becomes a linking loss area according to a linking type and padding data is recorded in the linking loss area.

[0007] FIG. 1C shows a data structure, in which 0KB linking is performed after performing 32KB linking. That is, FIG. 1C shows 0KB link recording in the second ECC block (the 32KB linking loss area) of FIG. 1B, and user data is recorded from the first sector of the second ECC block in which 0KB linking is performed. However, if the data type is '1b' in the last recording sector of the first ECC block of FIG. 1C, the next sector, that is, the first sector of the second ECC block, may be taken for a linking loss area and user data can be replaced with '00h'. Therefore, an error may occur in this sector, and as a result an ECC error occurs in the entire second ECC block and data in the second ECC block cannot be reproduced.

SUMMARY OF THE INVENTION

[0008] Accordingly, it is an object of the present invention to provide a recording medium having sectors where data is recorded, in which data in a sector is regarded as data in a linking loss area according to data type information.

[0009] It is another object of the present invention to provide a method of linking data, depending on effectiveness of data in a sector, which is determined by using data type information.

[0010] It is yet another object of the present invention to provide an apparatus linking data, depending on effectiveness of data in a sector, which is determined by using data type information.

[0011] Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0012] The foregoing and other objects of the present invention are achieved by providing a recording medium having sectors where data is recorded, in which each sector has a data identification area, in which information identifying the type of data recorded in the sector is recorded, and the data identification area indicates at least whether or not data recorded in the sector is linking data.

[0013] The above and other objects of the present invention may also be achieved by providing a method of linking data, the method having the operations of (a) dividing an error correction code block having a predetermined size into a plurality of sectors and checking data type identification information which indicates whether or not data in each sector is linking data; and (b) replacing main data of a sector with predetermined data according to the result of checking the data type identification information.

[0014] The above and other objects of the present invention may also be achieved by providing an apparatus linking data in a process recording and/or reproducing optical data, the apparatus having a checking unit checking and outputting the type of data if no error occurs in an error correction code block having a plurality of sectors, each sector having data type identification information which indicates that data recorded in the sector is linking data; and a replacing unit that replaces main data of a sector with predetermined data according to the data type output from the checking means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] These and other objects and advantages of the present invention will become more apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIGS. 1A, 1B, and 1C are schematic diagrams of the data structure in a conventional data linking method;

FIG. 2 is a block diagram of a digital versatile disc-recordable/rewritable (DVD-R/RW) apparatus;

FIG. 3 is a block diagram of the configuration of an apparatus providing linking data according to the present invention;

FIG. 4 is a schematic diagram showing the data structure of a data identification area, in which data type information is stored, according to the present invention; and

FIGS. 5A, 5B, and 5C are schematic diagrams of a data structure explaining a data linking method according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0017] The DVD-R/RW apparatus shown in FIG. 2 has a disc 20, a pickup 21, an auto laser power control (ALPC) 22, a radio frequency-amplifying unit 23, a data processor 24, a host interface 25, a host 26, a servo processor 27, a motor and driver 28, and a microcomputer (MICOM) 29.

[0018] The ALPC 22 controls the power of a laser beam emitted from the pickup 21, and the radio frequency-amplifying unit 23 amplifies a minute signal picked up from the disc 20. The data processor 24 processes link data in accordance with data types, performs detection, insertion, protection, modulation and demodulation of a synchronization signal, and generates various control signals for error correction and for controlling the radio frequency-amplifying unit 23. The host interface 25 connects the optical recording apparatus with a host 26. The servo processor 27 controls various motors and servos related to the disc 20 to perform tracking and focusing, etc. The motor and driver 28 performs a function of rotating the disc 20 and driving motors, and the MICOM 29 controls the overall operation of the optical recording apparatus.

[0019] FIG. 3 is a block diagram of the configuration of an apparatus linking data according to the present invention, and is a detailed diagram of the data processor 24 shown in FIG. 2. The data processor 24 of FIG. 3 has a data converting unit 24-1, a non-return-to-zero (NRZ) converting unit 24-2, a sync detecting unit 24-3, a demodulating unit 24-4, an identification error detection (IED) checking unit 24-5, a data type checking unit 24-6, and a data replacing unit 24-7.

[0020] The data converting unit 24-1 converts an analog signal, which is amplified and output by the radio frequency-amplifying unit 23, into non-return-to-zero inversion (NRZI)-type digital data. The NRZ converting unit 24-2 converts NRZI-type data, which is output from the data

converting unit 24-1, into NRZ-type data. The sync detecting unit 24-3 performs detection, protection, and insertion of various synchronization signals contained in NRZ data. The demodulating unit 24-4 demodulates the modulated 16-channel bits into 8 bits. The IED checking unit 24-5 checks whether or not an error exists in a data identification area in the demodulated data.

[0021] If the IED checking unit 24-5 indicates that there is no error in the data identification area, the data type checking unit 24-6 checks data type information in the data identification area.

[0022] FIG. 4 is a schematic diagram showing the data structure of a data identification area, in which data type information is stored, according to the present invention. The data identification area is formed with a sector information field and a sector number field. The sector information field is formed of a sector format type field, a tracking method field, a reflectance field, a reserve field, an area type field, a data type field and a number-of-layers field.

[0023] That is, sector format type information of bit position b31 indicates a constant linear velocity (CLV) or zone constant linear velocity (ZCLV) as follows:

0b: CLV format type

1b: Zoned format type, specified for Rewritable discs

[0024] Tracking method information of bit position b30 indicates pit tracking or groove tracking as follows:

0b: Pit tracking

1b: Groove tracking, specified for Rewritable discs

[0025] Reflectance information of bit position b29 indicates whether or not reflectance exceeds 40% as follows:

0b: Reflectance is greater than 40%

1b: Reflectance is less than or equal to 40%.

Bit position b28 indicates a reserve bit.

[0026] Area type information of bit positions b27 and b26 indicates a data area, a lead-in area, a lead-out area, or a middle area for a read-only disc as follows:

00b: Data area

01b: Lead-in area

10b: Lead-out area

11b: Middle area of read-only discs

[0027] Data type information of bit position b25 indicates read-only data, or the linking data as follows:

0b: Read-only data

1b: Linking data

[0028] Layer number information of bit position b24 indicates the number of layers in a single layer disc or a dual layer disc as follows:

0b: Layer 0 of dual layer disc or single layer disc

1b: Layer 1 of dual layer disc

[0029] A data identification area for storing data type information, as shown in FIG. 4, is recorded on a recording medium, such as an optical disc 20.

[0030] If data type information in bit position b25 of FIG. 4 is '1b', the data replacing unit 24-7 replaces main data in the corresponding sector, that is, the current sector, with '00h' and outputs '00h' to an external or internal memory (not shown).

[0031] FIGS. 5A, 5B, and 5C are schematic diagrams of a data structure explaining a data linking method according to the present invention, showing a 2KB link method, a 32KB link method and a 0KB link method, respectively.

[0032] In the linking method of the present invention, shown in FIGS. 5A, 5B, and 5C, if the data type contained in sector information is '1b', this indicates that the current sector is a linking loss area. A linking loss area has no effective data and only dummy data is recorded in the linking loss area. Therefore, main data recorded in the current sector is replaced with '00h' regardless of data to be reproduced, and correction of an ECC block can be improved.

[0033] FIG. 5A is a data structure in which the size of a linking loss area is 2KB (1 sector), and FIG. 5B is a data structure in which the size of a linking loss area is 32KB (16 sectors). If user data does not fill the entire first ECC block, padding data is recorded in the remaining part of the first ECC block. In the prior art, if the data type is '1b', the next sector is allocated as a linking loss area. However, in the present invention, the current sector is allocated as a linking loss area, and therefore the sector marked by '*', in which the last user data is recorded, has no meaning in the present invention. If the data type of the current sector of the second ECC block is '1b', the current sector is allocated as a linking loss area and main data in the current sector is replaced with dummy data '00h'.

[0034] FIG. 5C shows a data structure in which 0KB linking is performed after performing 32KB linking. That is, FIG. 5C shows 0KB link recording in the second ECC block (the 32KB linking loss) of FIG. 5B, and user data as main data is recorded in the first sector in which 0KB linking is performed. Also in FIG. 5C, if the user does not fill the entire first ECC block, padding data is recorded in the remaining part of the first ECC block. In the prior art, if the data type is '1b', the next sector is allocated as a linking loss area. However, in the present invention, the current sector is allocated as a linking loss area, and therefore the sector marked by '*', in which the last user data is recorded, has no meaning in the present invention. In addition, even if user data is recorded as 0KB in the second ECC block, which is linked by 32KB, the data type in the current sector is checked and the current sector can be allocated as a linking loss area. Therefore, the problem of error occurrence is solved. That is, since the data type of the current sector is '0b', main data is determined as user data and is not replaced with dummy data '00h'.

[0035] According to the method of the present invention, data type information is checked to determine whether or not to replace main data of the current sector with dummy data. By doing so, error occurrence of the prior art can be prevented and block error correction is more effectively carried out.

[0036] Although a few embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.